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SOME SANDSTONE WATERS OF GREAT PURITY.

By E. H. S. BAILEY, of Kansas University.

Read before the Academy, at Iola, December 31, 1901.

MANY attempts have been made to classify mineral waters, but as their composition is so complex, it is evident that any system that may be adopted will be somewhat defective. The simplest classification would be one that arranged in each group those waters having a predominance of similar constituents, or ions. The system which we have adopted is a modification of that proposed by some other chemists, and is as follows:

I, The Chloride group.
II, The Sulphate group.
III, The Chlor-sulphate group.
IV, The Carbonate group.
V, The Chlor-sulpho-carbonate group.
VI, The Sulphide group.
VII, The Chalybeate group.
VIII, The Special group.
IX, The Soft Water group.

It is my object to call attention to the last of these, the soft-water group. As such a large proportion of the rocks of Kansas are of calcareous origin, it is natural for us to infer that the waters are nearly all hard, from the presence of carbonates and sulphates of lime and magnesia. Fortunately, however, there are few areas where sandstone and other rocks prevail, and here we find excellent soft waters.

Among those that have been examined in the laboratory of the University, the following are worthy of special note; the amount of solid or mineral matter obtained in each case on evaporating a gallon of the water is expressed in grains:

Conway Springs	3.41	Delaware springs	8.27
Brookville No. 2*	3.84	Parker's	8.89
California	6.13	Linwood*	9.90
Cave spring	6.75	Chico spring	14.92
Brookville No. 1*	8.09	Kansas Clarus	20.83
Sand springs*	8.15		

*Carbon dioxide to form bicarbonates is not included.

These springs either flow from sand or from beneath sand rocks. These rocks often contain considerable iron and a little of this is almost always found in these waters. With the exception of the water found near Brookville, and that of the Conway Springs, the California spring contains less mineral matter than any that has been analyzed.

The California spring is said to have derived its name from its situation on one of the numerous trails leading across the state to the mountains and to California. It is situated on the southern slope of the broad valley of the Marais des Cygnes, about four miles northwest of Ottawa. The temperature of the water is 58° F., and the flow is 450 gallons per hour. There are no rare constituents in the water, as the following analysis shows:

Grams per liter.

IONS.	
Sodium (Na)	.0068
Calcium (Ca)	.0146
Magnesium (Mg)	.0018
Iron (Fe)	.0004
Chlorine (Cl)	.0106
Sulphuric acid ion (SO_4)	.0074
Silicic acid ion (SiO_3)	.0238

RADICALS.	
Sodium oxide (Na_2O)	.0092
Calcium oxide (CaO)	.0205
Magnesium oxide (MgO)	.0031
Iron oxide (FeO)	.0005
Chlorine (Cl)	.0106
Sulphuric anhydride (SO_3)	.0062
Silicic anhydride (SiO_2)	.0180
Carbonic anhydride (CO_2)	.0327
Water (H_2O)	.0067
Oxygen equivalent	.0024
Total	.1051

Hypothetically combined as follows:

	Grams per liter.	Grains per gallon.
Sodium chloride (NaCl)	.0174	1.018
Calcium sulphate ($CaSO_4$)	.0106	.618
Calcium bicarbonate ($CaH_2(CO_3)_2$)	.0466	2.721
Magnesium bicarbonate ($MgH_2(CO_3)_2$)	.0113	.661
Iron bicarbonate ($FeH_2(CO_3)_2$)	.0012	.071
Silica (SiO_2)	.0180	1.049
Totals	.1051	6.138

There is a demand for waters that are extremely pure in the treatment of certain diseases where an abundance of mineral matter is injurious. This water contains very much less solid matter than such waters as the Waukesha, Jackson Lithia, etc.—waters that are recommended more for their purity than for any special ingredients that they contain. There are waters found in the sandstone and granite regions of the East that are as pure as the California spring, and some actually contain less than two grains per gallon, but it is interesting to notice that we have in the middle West just as good waters, and that they are abundantly supplied in certain localities.